



Incidence of HIV Among Injection Drug Users Entering Drug Treatment Programs in Four US Cities

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ABSTRACT *We estimated seroincidence of human immunodeficiency virus (HIV) and prevalence of risk behaviors among injection drug users (IDUs) who accepted voluntary HIV testing on entry to drug treatment. Record-based incidence studies were conducted in 12 drug treatment programs in New York City ($n = 890$); Newark, New Jersey ($n = 521$); Seattle, Washington ($n = 1,256$); and Los Angeles, California ($n = 733$). Records of confidential HIV tests were abstracted for information on demographics, drug use, and HIV test results. More detailed data on risk behaviors were obtained by a standardized questionnaire. Although overall incidence rates were relatively low in this population ($<1/100$ person-years), there was a high prevalence of risk behaviors. Needle sharing was reported by more than one-third of the participants in each of the cities. HIV seroincidence rates were up to three-fold higher among younger IDUs. We found that HIV continued to be transmitted among IDUs who had received both drug treatment and HIV counseling and testing. HIV/AIDS (acquired immunodeficiency syndrome) prevention education should continue to be an important component of drug treatment.*

KEYWORDS *HIV, HIV Risk Behavior, Incidence, Injection Drug Use, Prevalence.*

Injection drug use continues to be an important risk factor for the transmission of human immunodeficiency virus (HIV). Approximately one-third of acquired immunodeficiency syndrome (AIDS) cases reported to the Centers for Disease Control and Prevention (CDC) are associated with injection drug use, either directly through the sharing of drug injection equipment or indirectly through sexual and perinatal transmission from injection drug users (IDUs).¹

To monitor trends in HIV prevalence in the US, CDC has conducted seroprevalence surveys in sentinel drug treatment centers nationwide. As documented by these surveys, geographic variation in HIV prevalence among IDUs entering treatment has changed little over time.²

Stable HIV prevalence may be a function of lower mortality and lower HIV incidence. Although HIV incidence studies can provide a more accurate assessment of ongoing HIV transmission among IDUs, only a few have been conducted because they have required many resources. Cohort studies conducted in selected groups of

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IDUs have produced estimates of HIV incidence that differ by geographic region and setting.³⁻⁷

HIV counseling and testing, which are routinely offered to clients in drug treatment programs, can provide useful data for monitoring HIV seroincidence among IDUs. We estimated seroincidence by means of record-based studies that linked the results of sequential confidential HIV tests among clients entering drug treatment programs. HIV seroprevalence estimates were obtained from anonymous, unlinked seroprevalence studies conducted at the same study sites. To obtain detailed information on risk behaviors, we recruited persons undergoing voluntary HIV testing to participate in a standardized interview at the time of the pretest counseling session.

In this article, we present estimates of HIV-1 seroprevalence, HIV-1 seroincidence, and sexual and needle-sharing risk behaviors in a population of IDUs admitted to drug treatment programs and participating in voluntary HIV counseling and testing in four US cities.

METHODS

All studies were conducted using standardized multicenter protocols that had been approved by CDC and local institutional review boards.

Anonymous Unlinked Seroprevalence Surveys

Residual specimens from sera collected for routine medical purposes from persons entering treatment for illicit drug use were tested for HIV antibodies after all personal identifiers (e.g., client's name, medical record number) had been permanently removed. Limited information on demographic characteristics, risk behaviors, and drug use was abstracted from client files at each survey site. Methods for these surveys have been described in detail elsewhere.^{2,8}

Record-Based Incidence Studies

Record-based incidence studies were implemented in drug treatment programs that had participated previously in CDC-funded, unlinked HIV seroprevalence surveys⁸ and that routinely provided voluntary HIV counseling and testing to all persons entering the programs. Information on demographics, drug use, other risk behaviors, and confidential HIV test results was abstracted from counseling and testing records. For this study, we used the records of persons who had used illicit or prescription drugs for nonprescribed purposes at least once within the past 12 months, who had a history of injecting drugs, and who had volunteered to participate in HIV counseling and testing. Records of sequential tests were stripped of all personal identifiers and linked by a unique identification number. Methods used to assign unique identifiers differed by site, but generally included an algorithm based on date of birth and social security number. Record matches were validated by examination of additional information at the site.

Data from drug treatment programs in New York City; Newark, New Jersey; Seattle, Washington; and Los Angeles, California, were used in this analysis. Study sites were selected by state and local health department personnel on the basis of client census, geographic representation, and racial/ethnic diversity. Programs in Newark, Seattle, and Los Angeles provided outpatient methadone detoxification services or methadone maintenance services. In New York City, the study was conducted in two settings: a large inpatient detoxification unit and an outpatient methadone maintenance treatment program that provided HIV counseling and testing

services at 15 sites citywide. No HIV testing beyond that routinely offered as part of the center's counseling and testing program was performed, and no separate consent was obtained for the record review.

Beginning in mid-1994 and continuing through 1997, demographic information, risk information, and HIV test results were abstracted prospectively from the counseling and testing records for all persons who received HIV testing and counseling either on entry to treatment or while in treatment. In New York City, counseling and testing records were available from 1990 onward; records from 1990 through 1994 were abstracted retrospectively and linked to records abstracted from 1994 through 1997. Retrospective data were not available from either Los Angeles or Seattle.

Routine HIV-1 antibody testing was done using an enzyme immunoassay licensed by the Food and Drug Administration. Sera that were repeatedly reactive were confirmed by Western blot or immunofluorescence assay. Western blot band patterns were interpreted according to the recommendations of the Association of Public Health Laboratories and CDC.⁹

Interview Studies

From October 1994 through December 1996, persons from study sites in Seattle and Los Angeles who received HIV counseling and testing and whose records were included in the record-based study were recruited for an interview study that obtained additional, detailed behavioral information. Persons in New York City were recruited between March 1995 and December 1996; the interview study was not conducted in Newark.

Persons who consented to participate in the interview study were administered a face-to-face standardized questionnaire by a trained interviewer at the pretest counseling session. The questionnaire included information on demographics, drug use, needle-sharing practices, condom use, history of sexually transmitted disease, and other HIV-related risk behaviors within the 6 months before the interview. Persons who consented to participate and who were found subsequently to be HIV negative were interviewed again 6 and 12 months later; we report results only from the baseline interview.

Statistical Analysis

Records for persons who were tested more than once either when readmitted to the drug treatment program or while in the same or another drug treatment program were included in the calculation of incidence rates. Only persons who tested seronegative or whose results were indeterminate by Western blot at baseline were included in the incidence analysis. Person-years of follow-up were calculated as the time between the first and last negative test results for persons who did not seroconvert during the study period and as the time between the first negative result and the midpoint between the last negative and the first positive test result for those who seroconverted. Because the actual time of seroconversion is unknown, this method provides the maximum likelihood estimate of incidence, assuming that the rate of HIV infection is constant over the study period. Seroconversion rates were calculated for the four cities and by demographic subgroups as the number of new HIV seroconversions per 100 person-years of observation. For this analysis, all Western blot indeterminate test results were considered HIV negative. Among clients participating in the interview studies, Mantel-Haenszel odd ratios (ORs) were calculated for selected baseline demographic and risk behavior characteristics. Confidence intervals (CIs) for point estimates of HIV incidence were calculated using a Poisson distribution.

TABLE 1. Participation rates for IDUs entering drug treatment who accepted confidential HIV testing, were eligible for the interview study, and participated in the interview study, 1994–1997*†

	Entering drug treatment,‡ N	Accepting confidential HIV testing		Eligible for participation in interview study		Participating in interview study	
		n	(%)	n	(%)	n	(%)
New York City	8,650	3,677	(43)	1,151	(31)	541	(47)
Newark	4,510	2,344	(52)	—	—	—	—
Seattle	3,410	2,184	(64)	1,375	(37)	976	(71)
Los Angeles	4,680	2,699	(58)	1,725	(64)	1,173	(68)

*IDUs— injection drug users.

†1990–1997 in New York City.

‡Estimated from clinic records, rounded to nearest 10.

RESULTS

A total of 12 drug treatment programs participated in the record-based study: 2 in New York City, 3 in Newark, 4 in Seattle, and 3 in Los Angeles. Of these programs, all but those in Newark conducted the interview study. Participation rates for voluntary HIV counseling, testing, and the interview study are shown in Table 1. A higher proportion of clients accepted confidential HIV testing in Seattle and Los Angeles than in Newark and New York City. In Los Angeles and Seattle, approximately two-thirds of those eligible agreed to be interviewed, whereas in New York City, the participation rate was one-half. Because the interview study was initiated after the record-based incidence study, not all persons who accepted HIV counseling and testing were offered participation in the interview study.

Unlinked Seroprevalence Surveys

HIV seroprevalence among IDUs receiving voluntary confidential HIV testing was compared with seroprevalence from unlinked surveys among IDUs entering the same drug treatment programs in each of the cities. HIV prevalence in 1997 among persons accepting confidential HIV testing was substantially lower than among persons in the unlinked surveys in New York City and Newark, but was similar in Seattle and Los Angeles (Table 2). Similar patterns were observed for previous years (1994–1996, data not shown).

Record-Based Incidence Studies

The proportion of all persons who accepted confidential HIV testing and were tested more than once (repeaters) was 25% in New York City, 28% in Newark, 61% in Seattle, and 28% in Los Angeles. Overall, the demographic characteristics of repeaters were similar to those of nonrepeaters (persons tested only once) in all four cities. Slightly more of the repeaters were more than 35 years of age in New York City (71% vs. 65%), Los Angeles (76% vs. 72%), and Seattle (71% vs. 63%); more repeaters were white in New York (33% vs. 29%) and Los Angeles (46% vs. 38%); and more repeaters were of races other than white (81% vs. 77%) or were female (44% vs. 33%) in Newark.

Of the 3,400 repeat testers, 25 seroconverted during the follow-up period, for

TABLE 2. HIV prevalence among IDUs entering drug treatment and IDUs accepting confidential HIV testing, 1997*

	Entering treatment†		Accepting confidential HIV testing	
	No. +/ No. tested	% +	No. +/ No. tested	% +
New York City	107/372	28.8	37/795	4.7
Newark	111/322	34.5	185/1,731	10.7
Seattle	9/524	1.7	10/859	1.2
Los Angeles	4/517	0.8	2/525	0.4

*IDUs— injection drug users.

†Based on unlinked HIV seroprevalence surveys.

an overall incidence rate of 0.5 per 100 person-years (CI 0.2–1.0 per 100 person-years). None of the clients in Los Angeles seroconverted. The average length of follow-up was 540 days. Age at seroconversion ranged from 27 to 57 years, and 44% of the clients were less than 35 years of age. Of those who seroconverted, 40% were female, and 32% were white.

Incidence was higher in New York City and Newark than in Seattle and Los Angeles (Table 3). In two of the three cities where seroconversions were observed, incidence was up to three-fold greater among IDUs less than 35 years of age than among those 35 years of age or older. Incidence rates were similar among whites and those of other races.

The number of seroconverters from each of the participating sites was not sufficient for multivariate analysis of factors associated with seroconversion.

Interview Studies

Among those eligible for the interview study, women were more likely to participate, as were persons less than 35 years of age. Racial and ethnic characteristics were similar among participants and nonparticipants. Overall, 75% of participants had entered drug treatment within the past 30 days.

A much higher proportion of participants in New York City were male compared to Los Angeles and Seattle. Most participants in Seattle were white, whereas the majority of participants in New York City and Los Angeles were other races. Most of the participants had a high school education, and approximately one-third had been incarcerated for some time during the past 6 months (Table 4). Needle sharing was reported by more than one-third of the participants in each of the cities, and indirect sharing (sharing cotton, cooker, or water) was reported by more than half of the participants. Approximately two-thirds of the participants in New York City and Seattle had obtained needles from a needle-exchange program. Participants in New York City were more likely to report more than one sex partner within the past 6 months, exchanging drugs or money for sex, or having had an HIV-positive sex partner ($P < .05$). Of all sexually active participants in the interview studies, 2.4% (42 of 1,755) reported a diagnosis of a sexually transmitted disease during the past 6 months.

Nearly all IDUs (95%) had injected drugs within the 6 months before their interview. The most frequently reported location for injecting was their own place

TABLE 3. Estimates of HIV incidence among injection drug users with repeat HIV tests, record-based incidence study, 1994–1997*

	Repeat testers, No.	Total py	Seroconverters	Incidence rate, % py	95% CI
New York City	890	1,529	14	0.9	0.5–1.5
Gender					
Male	632	1,039	10	1.0	0.5–1.8
Female	258	490	4	0.8	0.2–2.1
Age (years)					
<35	267	383	7	1.9	0.7–3.8
≥35	623	1,145	7	0.6	0.2–1.3
Race					
White	307	613	4	0.7	0.2–1.7
Other	569	896	10	1.1	0.5–2.1
Newark	521	755	7	0.9	0.4–1.9
Gender					
Male	292	424	4	1.0	0.3–2.4
Female	229	332	3	0.9	0.2–2.7
Age (years)					
<35	230	309	3	1.0	0.2–2.9
≥35	291	447	4	0.9	0.2–2.3
Race					
White	111	159	2	1.3	0.2–4.6
Other	404	590	5	0.9	0.3–2.0
Seattle	1,256	1,751	4	0.2	0.1–0.6
Gender					
Male	679	919	1	0.1	0.003–0.6
Female	577	832	3	0.4	0.07–1.1
Age (years)					
<35	365	522	4	0.8	0.2–2.0
≥35	891	1,229	0	0	0.0–0.2
Race					
White	901	1,257	2	0.2	0.02–0.6
Other	329	468	2	0.4	0.05–1.5
Los Angeles	733	969	0	0	0.0–0.3

CI, confidence interval; py, person-year.

*1990–1997 in New York.

of residence (76%), followed by the residence of a friend or relative (12%). Of those who injected drugs with another person, that person was most frequently the participant's steady sex partner (54%) or a relative (30%).

Participants who were less than 35 years of age differed from older participants in several ways. After we controlled for city, younger clients were more likely to have used needles after someone else (OR 1.7, 95% CI 1.4–2.0), to have shared works (OR 1.3, CI 1.1–1.6), and to have backloaded (i.e., injected with a needle after someone else had squirted drugs into it from his or her own needle) (OR 1.4, CI 1.1–1.7). Compared with older users, those less than 35 years of age were also more likely to be sexually active (OR 2.3, CI 1.8–2.9), to have had more than one sex partner (OR 1.4, CI 1.1–1.7), and to have been incarcerated for some time during the past 6 months (OR 1.3, CI 1.1–1.6).

TABLE 4. Characteristics of injection drug users at enrollment in interview study

	New York City (n = 541)		Los Angeles (n = 1,173)		Seattle (n = 976)	
	No.	(%)	No.	(%)	No.	(%)
Gender						
Male	405	(75)	731	(62)	503	(52)
Female	136	(25)	442	(38)	473	(48)
Age						
<35 years	211	(39)	264	(23)	314	(32)
≥35 years	330	(61)	909	(77)	662	(68)
Race						
White	132	(24)	408	(35)	736	(75)
Other	408	(76)	765	(65)	239	(25)
High school graduate	346	(64)	645	(55)	771	(79)
Incarcerated within past 6 months	173	(32)	199	(17)	342	(35)
Injected within past 6 months	449	(83)	1,138	(97)	956	(98)
Injected >4 times/day*	166	(37)	148	(13)	153	(16)
Injected cocaine*	225	(50)	341	(30)	392	(41)
Shared needles*,†,‡	175	(39)	512	(45)	488	(51)
Shared works*,§	233	(52)	626	(55)	688	(72)
Back-loaded*,‡	85	(19)	239	(21)	459	(48)
Used needle exchange	301	(67)	398	(35)	650	(68)
Sexually active¶	449	(83)	891	(76)	771	(79)
>1 sex partner#	229	(51)	258	(29)	193	(25)
Exchanged drugs/money for sex#	148	(33)	125	(14)	100	(13)
HIV+ sex partner#	81	(18)	18	(2)	31	(4)

*Among persons who had injected drugs within past 6 months.

†Used a needle that had been used by someone else.

‡“Ever” versus “never” within past 6 months.

§Shared cotton, cooker, or water.

||Obtained sterile needles from a needle-exchange program within past 6 months.

¶Participant had sex within past 6 months.

#Among persons who had sex within past 6 months.

DISCUSSION

We used standardized methods to estimate the prevalence and incidence of HIV and to describe risk behaviors among IDUs entering treatment in four cities in the United States. HIV incidence rates in New York City and Newark were approximately twice as high as in Seattle; no seroconversions were observed in Los Angeles. Along with results of earlier studies conducted in individual cities,³⁻⁷ these findings suggest that the incidence of HIV infection continues to be higher among IDUs in the Northeast than in the West, but that transmission is being sustained in both areas.

The HIV incidence was higher among younger clients in two of the three cities where seroconversions occurred. This finding is of concern given recent increases in the number of new heroin users who are under 25 years of age.¹⁰ Younger users, who recently have begun to inject drugs, may be more likely to practice riskier injection-related behavior⁴ and may enter a network of older users who are already infected.

The HIV risk behaviors, including needle sharing, have been measured among IDUs in various settings, including street outreach programs and drug treatment

programs.¹¹⁻¹³ As in those studies, IDUs in our study frequently reported needle sharing and other indirect sharing behaviors (more than 40%). These self-reported injection-related risk behaviors tended to be more common in Seattle and Los Angeles, where HIV infection was less prevalent. However, persons in New York City reported more sexual risk behaviors, including having more than one sex partner, exchanging money or drugs for sex, and having an HIV-positive sex partner. Epidemiological studies of HIV infection in IDUs need to focus not only on individual behaviors, but also on the patterns of interactions among persons and the characteristics of partners (e.g., the likelihood that the partner is infected) to further explain differences in HIV incidence and prevalence. A potential concern of the study is the reliability and validity of the self-reported risk behaviors. However, risk behavior information was obtained using standardized questionnaires administered by trained interviewers at pretest counseling sessions. Several studies have found that self-reported risk behaviors among drug users generally are valid and reliable, particularly when in-depth interviews are used.^{14,15}

The HIV prevalence in unlinked surveys of IDUs in New York City and Newark was approximately 25 times higher than in Los Angeles and Seattle. Reasons for the persistent differences in HIV prevalence among IDUs in different regions of the US remain unclear.² One possible explanation is that geographic areas with higher population densities and higher contact rates, such as metropolitan areas in the Northeast, may have larger social networks, thereby increasing the likelihood of risky contact with an HIV-infected person.^{16,17}

We also compared HIV prevalence among persons receiving voluntary confidential HIV counseling and testing with the results of anonymous, unlinked HIV serosurveys conducted in the same drug treatment programs. In New York City and Newark, HIV prevalence in unlinked serosurveys of all entrants was at least three-fold higher than among persons who volunteered to undergo HIV counseling and testing. In Los Angeles and Seattle, the prevalence frequencies were similar for these two groups. A lower proportion of IDUs received voluntary counseling and testing in New York City and Newark than in the other two cities. One possible explanation is that in the Northeast, where more IDUs are infected with HIV, more persons may have already known that they were HIV positive and thus did not elect to undergo HIV counseling and testing.¹⁸ IDUs in New York City and Newark could also have obtained HIV counseling and testing in settings other than drug treatment programs.¹⁹

Our study population comprised a selected group of IDUs who were entering drug treatment programs and who volunteered to undergo HIV testing more than once. Thus, the observed incidence rates are not generalizable to all IDUs in the four cities and may be lower than among IDUs not in treatment, although the populations of IDUs in treatment and those not in treatment overlap.^{4,5,20-22} Because the median age of persons in our study was 35 years, these estimates may not fully reflect the experience of young IDUs, who may be at greatest risk. IDUs in treatment tend to be older because programs usually require that clients have a well-established drug habit to receive treatment. In addition, other surveys^{23,24} suggest that IDUs who consent to HIV counseling and testing may practice fewer risk behaviors than those who do not consent to testing, thus leading to an under-representation of IDUs at risk for HIV infection. This further suggests that the prevalence and incidence of HIV infection may be lower in those who consent to HIV counseling and testing.

Other studies have suggested that HIV prevention efforts may be effective in the structured environment of drug treatment.^{25,26} Apart from promoting the prevention of continued illicit drug use, these programs should encourage more per-

sons to accept voluntary HIV counseling and testing, especially client-centered counseling, which may be more likely to produce sustained behavior changes.²⁷ In our study, approximately one-third of the population had been incarcerated at least once during the 6 months before the interview, suggesting the importance of correctional facilities as additional sites for intervention to prevent drug injection and other behaviors that increase the risk for HIV infection.^{28,29}

We found that HIV transmission continued to occur among IDUs who had received both drug treatment and HIV counseling and testing. A need exists for additional strategies to reduce the risk of HIV transmission among IDUs, whether in treatment or out of treatment. Although most studies of the effects of prevention among drug users focus on behavior change over time, the incidence of HIV infection is an important measure of effective prevention. The development of new methods for basing incidence estimates on cross-sectional samples (without the need for follow-up) will allow much closer monitoring of incidence in high-risk populations, including IDUs.³⁰

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